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Semi Annual Progress Report, January 1-July 31, 1952

Contract No. Nonr - 116 (00), University of Texas

Research on Spore Formation and Spore Germination in Bacteria

Responsible investigator: J.W. Foster, Professor of Bacteriology

Title of Project: Spore formation and spore germination in bacteria

Objectives: Study of the fundamental biological and biochemical nature of those processes.

Seventeen different enzyme systems, including catalase, transaminases, oxidases, deaminases and dehydrogenases, abundantly demonstrable in vegetative cell extracts of B. mycoides and other aerobic spore forming bacilli, could not be detected in spore cell extracts tested concomitantly. This supports the hypothesis previously advanced by us that sporogenesis occurs at the expense of (enzyme) proteins preexisting in the vegetative cell. The latter apparently are almost completely sacrificed. The rate of destruction is selective, some enzymes, notably those involved in carbohydrate oxidative metabolism are lost much faster than others, for example, those dealing with amino acid metabolism. The latter are believed to presist adaptively because of their specific substrates are involved in sporogenesis, whereas the oxidative enzymes in the absence of specific substrates are early destroyed. Degradation of the oxidative enzymes presumably furnishes the substrates for the amino acid enzymes. In the presence of carbohydrate as a substrate the enzymes concerned with its metabolism are substantially preserved, and the cell persists in the vegetative state.

They hypothesis is presented that the bulk of spore protein is enzymatically nonfuctional. The spore is regarded as a nucleus accompanied by a storage protein pool. The latter provides the raw materials, precursors, (probably low molecular weight compounds) of enzymes characteristic of the vegetative state.

A spore is thus visualised as a cell possessing the capacity for enzyme synthesis from the extranuclear protein. This capacity may reside either in the nucleus, in the cytoplasm, or both. It is probable that the process of germination actually represents a period of differential synthesis of enzymes from endogenously produced precursors, in contrast to a net increase in cytoplasmic mass which involves exogenous nutrition.(growth).